

work, especially on volcanic questions, in Zittel's "History of Geology" or Geikie's monumental "Text-book." Ampferer's recent exposition of "Unterstromung," moreover, as a cause of mountain-crumpling comes very near in many of its details, though not in its foundations, to Reyer's theory of superficial "Stromung" (see *NATURE*, vol. lxxvi., 1907, p. 423). Though Ampferer quotes very few authorities, it seems likely that Reyer's views are still fructifying, even if they bear forbidden fruit. At any rate, we may welcome his return to the arena at a time when no champion can assert that his own views on mountain-building have satisfied all known conditions.

Mr. Reyer himself, in this clearly-written treatise, proposes to leave his statements and arguments unburdened by a bibliography. The numerous illustrative diagrams suggest in most cases drawings made from models, and some of them represent the results of experiments performed in plastic materials. There is a freshness of exposition that brings home to us many facts that are familiar, but which are often liable to be passed over without adequate consideration. The exposition itself is, if we may say so, diagrammatic. The author points out very early how delta-deposits slide upon the rocks beneath them, and how a loose valley-side moves out towards the river, which carries away the material, and thus renders the land-flow less apparent. From p. 52 onward we read of massive extrusions of material from the molten interior of the earth, and we remember the sliding of the deltas when we are asked to picture successive extrusions as lifting the crust above them and allowing of a lateral slip of the ruptured sedimentary layers. The great difference between these postulated extrusions and our common notions of intrusive bodies appears to lie in their long-continued and successive character, whereby a later igneous mass causes a previous one to bulge up and swell out as a coat, through which the later mass may break. It is urged that if this occurs below a deep ocean, the extruded matter may become as crystalline as granite, and subsequent sediments may be laid down on it with a false appearance of having been invaded.

All this should probably be kept in mind, but we doubt if the average field-observer has been so often misled as Mr. Reyer would wish us to believe. He opposes the idea of the differentiation of a common igneous magma (p. 61), since acid and basic magmas must have separated early in the history of a cooling globe, and massive protrusions are likely to mix them up again, so as to produce the phenomena observed. Such protrusions or extrusions are held to be sufficient to explain the existence of infolds of sediments between adjacent igneous masses (pp. 69 and 155); and an admitted revival of the "crater of elevation" theory appears on p. 73. There is much in the book that is in pleasant accord with the views consistently maintained in Britain in regard to the relations of various types of igneous rock; and the principle of successive extrusions (or may we say intrusions?) has been adopted, to mention only two examples, by Prof. Sollas for

the Leinster Chain and by Dr. Harker for the gabbros of the Cuillin Hills.

Mr. Reyer's views cannot fail to make us think more carefully, and we trust that his book will be widely read by those who have to interpret the history of great regions of the crust. We may hereafter be grateful to him for maintaining the theory of gravitational gliding (pp. 142, 147, &c.) as opposed to the crumpling of strata by lateral thrust against the influence of gravitation. In this respect he has relighted a very ancient candle, which burnt brightly in Scrope's hands in 1825 ("Considerations on Volcanos," pp. 201-2). It will now, in all probability never be entirely put out. GRENVILLE A. J. COLE.

HYDRAULICS.

Hydraulics. By F. C. Lea. Pp. xii+536. (London: Edward Arnold, 1908.) Price 18s. net.

WHATEVER may be the extent to which the science of hydraulics was neglected during the century which elapsed between the theoretical researches of Bernouilli and the practical applications of Armstrong, it cannot be urged that there is any lack of attention to the subject at the present time, if one be permitted to judge from the number of text-books which have appeared within recent years, and even within the last few months. So striking an output must surely be fraught with great potentialities.

The science of hydraulics has a field which is somewhat vague and ill-defined, and is of greater or less extent according to the views of different writers. Originally, the definition of the term only covered a reference to the laws which governed the motion of fluids in pipes and water-courses. Then it was extended to include the use of water for motive purposes, and the means and appliances by which that end was achieved. Other developments have followed, and now it is rare to find two text-books covering even approximately the same ground, or agreeing in respect of either limits or order of treatment. We are acquainted with one treatise which includes within its purview the principles of lubrication; with another which regards what is commonly differentiated as the science of pneumatics as a constituent section; with a third which ignores the motion of bodies in fluids; and so on.

The range of the treatise under consideration, though not so extreme as in some cases, is nevertheless exceedingly comprehensive, and it may be added that the treatment is very complete. In view of the license to which allusion has just been made, we do not presume to offer any criticism on the propriety of presenting the elementary principles of hydrostatics as an introduction to the subject; we ourselves should hardly have thought of referring to a text-book on hydraulics for them. No doubt it is useful for the student to have his memory refreshed on fundamentals, though he may not unreasonably be supposed to have acquired a competent knowledge of them elsewhere. Still, there they are for consultation, if required, and they form a not inapt introduction.

The laws governing floating bodies are touched upon, and investigation is carried so far as to cover the eminently practical and up-to-date case of the floating dock. From these considerations, the author proceeds to deal with the subject of fluids in motion, which constitutes the essential feature of the book. He makes Bernouilli's theorem his starting-point, following on to Torricelli's law and the theory of flow through mouthpieces with the coefficients due to various forms of orifice. Then, having dealt with weirs, he directs his attention to fluid flow through pipes and channels, explaining the well-known basic formula,

$$v = c \sqrt{mi},$$

and quoting the values assigned to the coefficient by Chezy, Bazin, Darcy, Ganguillet and Kutter, and others. This brings us to chapter vii., in which we find a description of the methods adopted for gauging the flow of water through an orifice, in streams and in pipes, including a brief reference to Stromeyer's suggestion for the use of a chemical agent. Chapter viii. treats of the impact of water on vanes, and thence it is a natural transition to water-wheels and turbines in chapter ix. Both this chapter and the following, on pumps, are very full and explicit, and are effectively illustrated by a number of typical examples. Chapter xi. is devoted to an exemplification of the application of hydraulic power to industrial purposes by means of various machines. In two short concluding chapters the author deals with the modern investigation of stream-line flow and the resistance to motion of bodies in water.

An admirable feature of the work is the large number of worked numerical examples. The type is clear and the illustrations are good. Altogether the work forms an excellent text-book, and is cordially to be recommended to students of this most interesting and useful science.

TECHNICAL CHEMICAL ANALYSIS.

Traite complet d'Analyse chimique appliquée aux Essais industriels. By J. Post and B. Neumann. Second French edition, by Dr. L. Gautier. Vol. i., part i. (pp. 217, price 6.50 francs). Vol. ii., part i. (pp. 202, price 6 francs). (Paris: Librairie scientifique, A Hermann, 1907-8.)

THE present review is concerned with the first two instalments of the second French edition of a German treatise on technical chemical analysis, which has already passed through three editions in the original. The complete work will consist of two volumes divided into eight sections, each section dealing with some special branch of analytical practice, and the editors have secured the cooperation of some twenty-seven eminent contributors in order that the various chapters may embody the results of the latest experience. Judging by the style of the first two sections, now before us, it would appear that the editors are aiming rather at a clear and succinct outline of contemporary analytical method, and of the general

nature of the materials to which they are applied, than at an elaborate and detailed treatise. Subject to this proviso, they may be congratulated on having so far achieved a considerable measure of success, and their efforts may be commended to British chemists who feel the need of a manual of this description.

Vol. i., part i., deals with such subjects as water, solid fuels, pyrometry, and gas analysis in a fairly complete and satisfactory manner. The opening chapter on water analysis (pp. 1-38), by Dr. H. Vogel, of Berlin, is somewhat too compressed and desultory to be of real use, and might be advantageously enlarged in future editions. Then follows an excellent *résumé* by Dr. H. Langbein of the methods in vogue for the chemical analysis and calorific valuation of solid fuels (pp. 39-73); the value of this chapter would have been enhanced by a fuller treatment of the ash analysis of coals and its importance in relation to the various uses of the raw fuel. The third chapter, by Prof. B. Neumann, of Darmstadt, on pyrometry (pp. 74-126), deals very completely with the various thermoelectrical and optical methods used in technical practice, and so far as these methods are concerned the treatment of the subject is all that could be desired. The scanty references to the air thermometer and to electrical resistance methods are, however, to be regretted.

The concluding chapter, on gas analysis (pp. 127-217), also by Prof. Neumann, is disappointing in that it deals with little else than the crude and untrustworthy methods of Hempel and Orsat (or various modifications of them), which have long been the despair of workers, who instinctively demand something both accurate and convenient, and which, we had hoped, were being rapidly discarded in technical laboratories. In these days, when the applications of gaseous fuels are increasing daily, the introduction of really accurate methods of gas analysis in technical practice is fast becoming an urgent necessity, and it is quite a mistaken notion that methods of precision are necessarily inconvenient or tedious, and therefore unsuited to the exigencies of a works laboratory. The opinion of Dreschmidt, quoted on p. 136, as to the incompleteness of the absorption of carbonic oxide by an ammoniacal solution of cuprous chloride may be disputed, since it can easily be demonstrated that a properly prepared and *fresh* solution will absorb the gas almost as rapidly, and, for all practical purposes as completely, as a caustic alkali absorbs carbon dioxide. It may also be remarked that there is no reference to gas calorimetry in this chapter.

Vol. ii., part i., dealing with the physical, mechanical, and chemical testing of limestones, mortars, cements, ceramic products, glass, and the like, has been entrusted to Drs. H. Seger and E. Cramer, of Berlin. Their treatment of the subject is admirably clear and succinct, and will certainly be appreciated by all general readers. Whilst there is nothing very new, good judgment has been exercised in selecting the best methods and appliances, and the whole is a singularly well-balanced production, and eminently readable. The one fault to be found with their work is the paucity of the references to analytical literature.